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EDUCATION

PhD in Physics

Sept 2017 - May 2023

University of Wisconsin-Madison

Dissertation: “Investigation of Higgs Boson Decaying to Di-muon, Dark Matter Produced in Association with a Higgs Boson Decaying to b-quarks and Unbinned Profiled Unfolding”

Master of Science in Physics

Sept 2013 - Jul 2015

National Tsing Hua University

Thesis: “Dark Matter Induced Mikheyev-Smirnov-Wolfenstein (MSW) Effects in the Sun and in Core-Collapse Supernovae”

Bachelor of Science in Physics

Sept 2009 - Jun 2013

National Tsing Hua University

PROFESSIONAL EXPERIENCE

Machine Learning Postdoctoral Research Fellow

June 2023 - Present

Scientific Data Division, LBNL / Dr. Paolo Calafiura

Berkeley, CA

- Developing a deep learning pipeline (using Graph Neural Network) to measure particle trajectories in High-Energy Physics detectors.
- Developing a generative model of hadronic interactions and tune it to Geant 4 and experimental data.
- Developing ML-based unfolding algorithms for particle physics.

Machine Learning for Particle Physics

Sept 2022 - May 2023

LBNL / Dr. Benjamin Nachman

Berkeley, CA

- Developing novel ML applications for particle physics, including data unfolding and event simulation with generative models; contributed to 3 projects with 1 first author journal publication.
- Translated abstract ideas into efficient and well-documented code using PyTorch, TensorFlow and Jupyter Notebook; successfully demonstrated proposed methods with practical examples.

ATLAS ITk Pixel Upgrade

Sept 2021 - Aug 2022

LBNL / Dr. Maurice Garcia-Sciveres

Berkeley, CA

- Designed experiments and troubleshooting to validate the ATLAS ITk pixel modules and readout chips.
- Performed extensive electrical tests on pre-production (ITkPixV1.1) modules and chips with promising results, leading to submissions of module pre-production and chip production.
- Developed three robust 0-1 software tools using Python and C++ to automate the pixel module QC test procedure (interacting with hardware instruments, YARR and production database); successfully implemented and in use across several leading institutions, including ANL, LBNL, and SLAC.

ATLAS Experiment

May 2018 - Present

CERN / Prof. Sau Lan Wu

Geneva, Switzerland

- Strongly contributed to 4 physics analyses ($H \rightarrow \mu\mu$, mono- $H(bb)$, Higgs combination and 2HDM+a combination); presented 5 approval talks, resulting in 3 journal papers and 4 ATLAS conference notes.
- Developed ML-based categorization for 2 analyses ($H \rightarrow \mu\mu$ and mono- $H(bb)$); enhanced sensitivity by over 200% for mono- $H(bb)$ and 30% for $H \rightarrow \mu\mu$.

- Developed statistical framework and performed statistical fitting for all 4 analyses; delivered statistical results as well as visualization plots.
- Supporting note editor for $H \rightarrow \mu\mu$ paper, $H \rightarrow \mu\mu$ EPS 2019 CONF NOTE, mono- $H(bb)$ and 2HDM+ a combination CONF NOTE.
- Liaison between mono- $H(bb)$ and 2HDM+ a combination team.
- Nominated as analysis contact for 2HDM+ a combination full run-2 publication.

Anomaly Detection

CERN / Prof. Sau Lan Wu

Jan 2021 - Sept 2021

Geneva, Switzerland

- Developed anomaly detection strategies with unsupervised machine learning methods including Variational Autoencoder and Isolation Forest.
- Successfully demonstrated the methods by re-discovering the Higgs boson from the ATLAS $ZZ \rightarrow 4\ell$ dataset at over 10 standard deviations.

ATLAS ITk Software Upgrade

CERN

Aug 2018 - Jul 2019

Geneva, Switzerland

- Documented in details the materials and parameters of ITk simulation based on current design.
- Updated material parameters of ITk pixel chips and hybrid with precise values; ran simulations with single muon and $t\bar{t}$ events and evaluated impacts on performance (radiation length, interaction length, detector resolution and efficiency).
- Validated new geometry versions by comparing detector performance.
- Developed a common plotting tool for radiation length comparison, and differential radiation length; still in use in the ITk software upgrade community.

High Energy Physics - Phenomenology

NTHU / Prof. Pai-hsien Jennifer Hsu, Prof. Kingman Chang

Jul 2016 - Jun 2017

Hsinchu, Taiwan

- Created a Machine Learning method to improve discrimination of Higgs boson production modes using Boosted Decision Tree, resulting in publication of the project in Physics Review D.

High Energy Physics - Phenomenology

NTHU / Prof. We-Fu Chang

Nov 2013 - Jun 2016

Hsinchu, Taiwan

- Estimated Dark Matter distribution numerically in astronomical objects (Sun, supernovae and the Galaxy)
- Calculated impacts of Dark Matter on neutrino oscillations with the assumption of Dark Matter-neutrino interactions; set 2 times stronger constraint on Dark Matter-neutrino coupling strength.

Nano electronics and spintronics

NTHU / Prof. Rai-Nien Kwo

Jul 2013 - Nov 2013

Hsinchu, Taiwan

- Studied 214 p-wave superconductor with the molecular beam epitaxy System (MBE).
- Fabricated two new Strontium Ruthenate (SRO) targets; validated composition of targets with Scanning Electron Microscope (SEM).

PUBLICATIONS

[Full list](#) of papers with the ATLAS collaboration.

Refereed Journal Articles

- [1] **J. Chan** and B. Nachman, “Unbinned Profiled Unfolding,” [arXiv:2302.05390 [hep-ph]].
- [2] The ATLAS Collaboration (Coauthor), “A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery,” *Nature* **607**, no.7917, 52-59 (2022) [erratum: *Nature* **612**, no.7941, E24 (2022)] doi:10.1038/s41586-022-04893-w [arXiv:2207.00092 [hep-ex]].
- [3] The ATLAS Collaboration (Coauthor), “Search for dark matter produced in association with a Standard Model Higgs boson decaying into b-quarks using the full Run 2 dataset from the ATLAS detector,” *JHEP* **11**, 209 (2021) doi:10.1007/JHEP11(2021)209 [arXiv:2108.13391 [hep-ex]].
- [4] The ATLAS Collaboration (Coauthor), “A search for the dimuon decay of the Standard Model Higgs boson with the ATLAS detector,” *Phys. Lett. B* **812**, 135980 (2021) doi:10.1016/j.physletb.2020.135980 [arXiv:2007.07830 [hep-ex]].
- [5] **C. H. Chan**, K. Cheung, Y. L. Chung and P. H. Hsu, “Vector Boson Fusion versus Gluon Fusion,” *Phys. Rev. D* **96**, no.9, 096009 (2017) doi:10.1103/PhysRevD.96.096009 [arXiv:1706.02864 [hep-ph]].

ATLAS Conference Notes

- [1] “Combined measurements of Higgs boson production and decay using up to 139 fb^{-1} of proton-proton collision data at $\sqrt{s} = 13 \text{ TeV}$ collected with the ATLAS experiment,” [ATLAS-CONF-2021-053].
- [2] “Combination and summary of ATLAS dark matter searches using 139 fb^{-1} of $\sqrt{s} = 13 \text{ TeV}$ p p collision data and interpreted in a two-Higgs-doublet model with a pseudoscalar mediator,” [ATLAS-CONF-2021-036].
- [3] “Search for Dark Matter produced in association with a Standard Model Higgs boson decaying to b -quarks using the full Run 2 collision data with the ATLAS detector,” [ATLAS-CONF-2021-006].
- [4] “A search for the dimuon decay of the Standard Model Higgs boson in pp collisions at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS Detector,” [ATLAS-CONF-2019-028].

ATLAS Public Notes

- [1] “Expected tracking and related performance with the updated ATLAS Inner Tracker layout at the High-Luminosity LHC,” [ATL-PHYS-PUB-2021-024].
- [2] “Dark matter summary plots for s -channel and 2HDM+ a models,” [ATL-PHYS-PUB-2021-045].

AWARDS

2023 Two Sigma PhD Fellowship, nominated by Physics Department Chair, UW-Madison	Nov 2022
Research Fellowship, Machine Learning for HEP, LBNL	Sept 2022
Research Fellowship, ITk Pixel Upgrade, LBNL	Sept 2021
US-ATLAS Center (ATC) Funding Award, ITK Pixel Upgrade, US-ATLAS	Sept 2021
Allan M. and Arline B. Paul Physics Award, UW-Madison	Jul 2021
Admitted to the 5 th Summer School on ML in HEP with Grant, DESY, Hambrug, Germany	Jul 2019
1 st Prize for the project competition at the 44 th SLAC Summer Institute	Aug 2016
Honor Roll of CoS Elite Scholarship	Sept 2013
Honor Roll of CoS Chen-Wen Elite Scholarship	Sept 2009

PRESENTATIONS

Conferences and Workshops

Contributed Talk, “Unbinned Profiled Unfolding”, APS April Meeting, Minneapolis	Apr 2023
Invited Talk, “Serial powering for ATLAS ITk pixel modules”, Pixel, Santa Fe	Dec 2022
Invited Seminar, “Search for the Higgs boson decaying to dimuon”, Research Progress Meeting, LBNL, Berkeley	Nov 2022
Poster, “Search for the Higgs boson decaying to a pair of muons in pp collisions at 13 TeV with the ATLAS detector”, ICHEP, Bologna	Jul 2022
Poster, “Search for the Higgs boson decaying to a pair of muons in pp collisions at 13 TeV with the ATLAS detector”, LHCP, Taipei	May 2022

Poster, “Search for Dark Matter produced in association with a Standard Model Higgs boson decaying to b-quarks using the full Run 2 collision data with the ATLAS detector”, LHCP, Taipei	May 2022
Invited Talk, “Search for rare and exotic decays of the Higgs boson in ATLAS”, Pheno 2022, Pittsburg	May 2022
Contributed Talk, “Search for Dark Matter produced in association with a Higgs boson decaying to a pair of b quarks and combination of Dark Matter search with 2HDM+a with the ATLAS detector”, APS April Meeting, New York	Apr 2022
Invited Talk, “Searches for dark matter with the ATLAS detector”, SUSY 2021, Online	Aug 2021
Poster, “Search for Dark Matter produced in association with a Higgs boson decaying to a pair of b quarks at 13 TeV with the ATLAS detector”, EPS-HEP, Online	Jul 2021
Contributed Talk, “Search for the Higgs Boson Decaying to a Pair of Muons in pp Collisions at 13 TeV with the ATLAS Detector”, DPF, Virtual	Jul 2021
Invited Talk, “ $H \rightarrow \mu\mu$, $H \rightarrow ee$ and $H \rightarrow e\mu$ in the Future”, HZZ workshop, CERN	Nov 2020
Young Scientist Forum, “Search for the Higgs Boson Decaying to a Pair of Muons in pp Collisions at 13 TeV with the ATLAS Detector”, Higgs 2020, Online	Oct 2020
Contributed Talk, “Dark Matter searches with the ATLAS Detector”, NCTS Dark Physics Workshop, Hsinchu	Jan 2020
Contributed Talk, “BDT Categorization in the Search of $H \rightarrow \mu\mu$ ”, 4 th ATLAS Machine Learning Workshop, CERN	Nov 2019
Contributed Talk, “Search for the Higgs Boson Decaying to a Pair of Muons in pp Collisions at 13 TeV with the ATLAS Detector”, US ATLAS Physics Workshop, UMass Amherst	Aug 2019
Contributed Talk, “Search for the Higgs Boson Decaying to a Pair of Muons in pp Collisions at 13 TeV with the ATLAS Detector”, DPF, Northeastern University	Jul 2019
Invited Talk, “Study of ITK-Pixel Chip and Hybrid Materials”, ATLAS Upgrade Week, Pixel and Strip Software, CERN	Apr 2019
Contributed Talk, “Improving Discrimination of VBF and ggH for Higgs coupling measurement at the LHC”, Annual Meeting of the Physical Society of Republic of China (PSROC), Tamsui	Jan 2017
Contributed Talk, “Accumulation of Dark Matter in the Sun and its implication”, 4 th International Workshop on Dark Matter, Dark Energy and Matter-Antimatter Asymmetry, Hsinchu	Dec 2016
Poster, “Dark matter induced MSW effects in the Sun”, 44 th SLAC Summer Institute, SLAC	Aug 2016
Contributed Talk, “Dark matter induced MSW effects in the Sun”, Annual Meeting of the Physical Society of Republic of China, Kaohsiung	Jan 2016

ATLAS Approval and ATLAS Plenary Talks

Higgs Approval for Higgs coupling combination analysis	Sept 2021
Analysis Presentation for 2HDM+a combination analysis at ATLAS Approval Meeting	Jul 2021
Analysis Presentation for monoHbb analysis at ATLAS Approval Meeting	Feb 2021
“Dark Matter Searches for Moriond & 2HDM+a Combination Plans”, Exotics Plenary P&P Week, CERN	Nov 2020
Higgs Unblinding Approval for $H \rightarrow \mu\mu$ analysis	May 2020
Higgs Unblinding Closure for $H \rightarrow \mu\mu$ analysis	Jun 2019

SKILLS

Programming	Python, C/C++, Git, L ^A T _E X, Bash, Mathematica, MySQL, C#
Machine Learning	BDT, Neural Network, RNN, Deep Sets, Attention, Transformer, GNN, Autoencoder, Variational Autoencoder, GAN, Normalizing Flow, XGBoost, Scikit-Learn, TensorFlow/Keras, PyTorch
Languages	Mandarin (native), English (fluent), Taiwanese (fluent), German (basic), French (basic)
Other	GitLab, GitHub, Docker, Electronics

LEADERSHIP

Nominated as Analysis contact , for 2HDM+a combination publication	2022
Liaison , between the monoHbb analysis team and the 2HDM+a combination team, ATLAS	2020 - 2021
Editor , 2HDM+a combination analysis support note, ATLAS	2020 - 2021
Editor , mono- $H(bb)$ analysis support note, ATLAS	2019 - 2020
Editor , ATLAS Higgs $\rightarrow \mu\mu$ search paper support note, ATLAS	2019 - 2020
Editor , ATLAS Higgs $\rightarrow \mu\mu$ search EPS 2019 support note, ATLAS	2019

TEACHING

Teaching Assistant, Undergraduate Physics , UW-Madison	Sep 2017 - May 2018
<ul style="list-style-type: none"> Performance evaluated to be “Excellent” (top rating) with the score of 4.72/5.0 for Fall and 4.54 for Spring. 	
Teaching Assistant, Electromagnetism , NTHU	Sep 2015 - Jun 2017
Teaching Assistant, Quantum Mechanics , NTHU	Sep 2014 - Jun 2015
Teaching Assistant, Optics Lab , NTHU	Sep 2013 - Jun 2014
Teaching Assistant, Applied Electronics Lab , NTHU	Sep 2012 - Jun 2013

OUTREACH

- Shared experience of studying abroad on social media ([Facebook](#), [Instagram](#)), American Institute in Taiwan **Feb 2023**
- Member of Lambda Alliance ERG, LBNL **Sept 2022 - Present**
- Participated in monthly ERG meeting.
 - Participated in the 2022 San Francisco Pride Parade.
- Introduced High Energy Particle Physics to the Wisconsin Taiwanese Student Association, “The smallest particle created by the largest experiment”, UW-Madison **Sept 2020**
- Presented a talk on High Energy Physics to high school students, “Are we in danger with the black holes created by LHC?”, The Affiliated Senior High School of National Taiwan Normal University, Taipei **Dec 2019**
- Member of CERN LGBT Club, CERN **May 2018 - Present**
- Organized the 2019 Geneva Pride activities.
 - Organized the 2018 LGBTSTEM Day.

REFERENCES

- Prof. Sau Lan Wu
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